Fig. 1

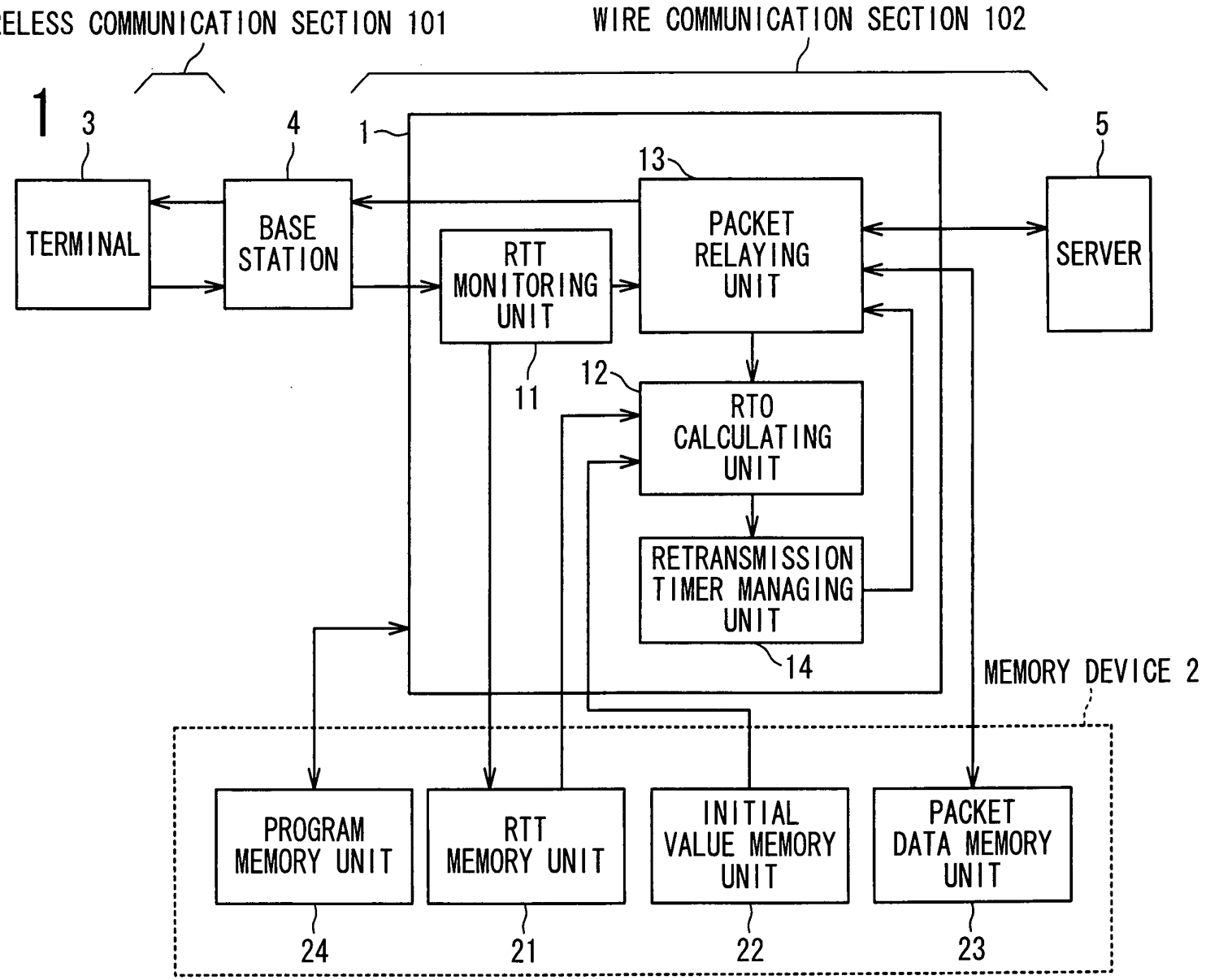

WIRELESS COMMUNICATION SECTION 101
WIRE COMMUNICATION SECTION 102
3
4
1
13
5
TERMINAL
BASE STATION
RTT MONITORING UNIT
PACKET RELAYING UNIT
SERVER
11
12
RTO CALCULATING UNIT
RETRANSMISSION TIMER MANAGING UNIT
14
MEMORY DEVICE 2
PROGRAM MEMORY UNIT
RTT MEMORY UNIT
INITIAL VALUE MEMORY UNIT
PACKET DATA MEMORY UNIT
24
21
22
23

Fig. 2

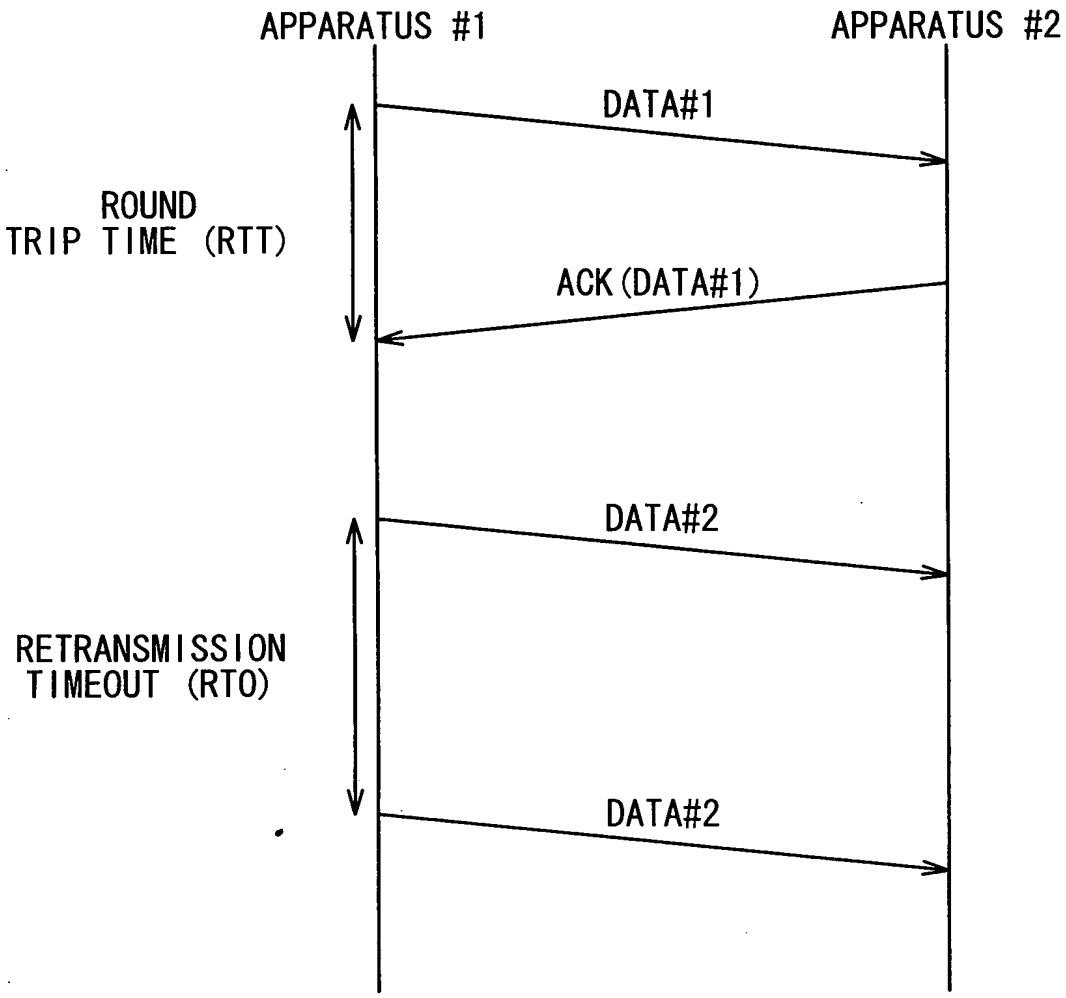
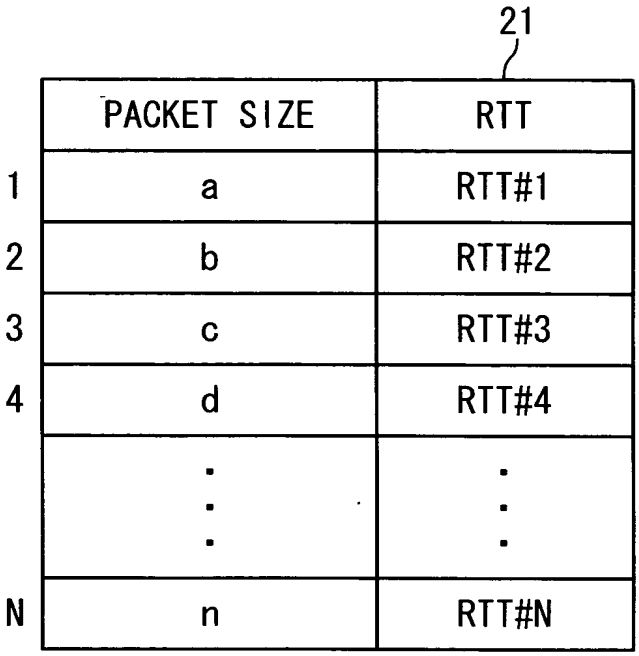

APPARATUS #1
APPARATUS #2
DATA#1
ROUND
TRIP TIME (RTT)
ACK(DATA#1)
DATA#2
RETRANSMISSION
TIMEOUT (RTO)
DATA#2

Fig. 3



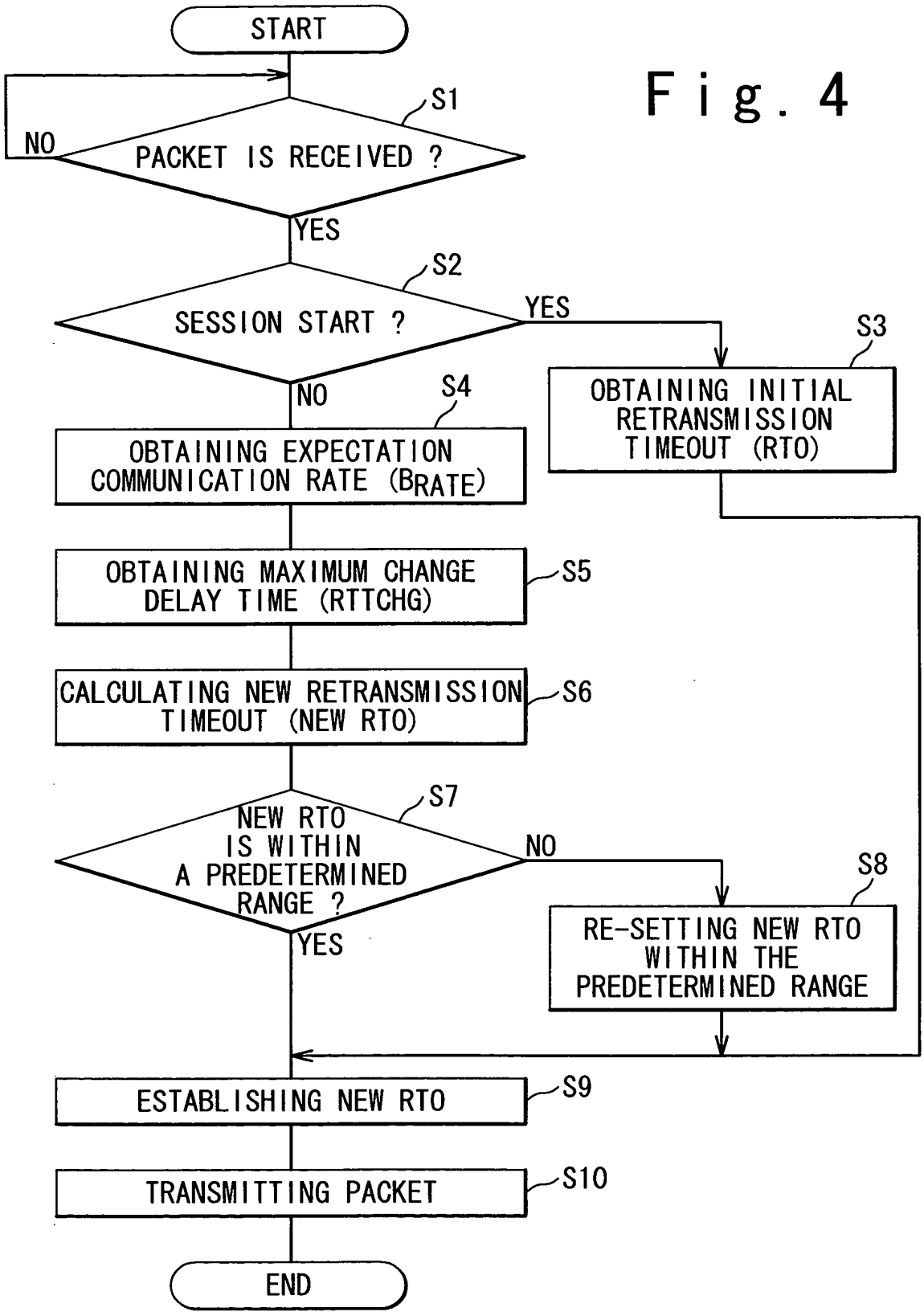

START
S1
PACKET IS RECEIVED ?
NO
YES
S2
SESSION START ?
YES
NO
S3
OBTAINING INITIAL RETRANSMISSION TIMEOUT (RTO)
S4
OBTAINING EXPECTATION COMMUNICATION RATE (BRATE)
OBTAINING MAXIMUM CHANGE DELAY TIME (RTTCHG)
S5
CALCULATING NEW RETRANSMISSION TIMEOUT (NEW RTO)
S6
S7
NEW RTO IS WITHIN A PREDETERMINED RANGE ?
NO
YES
S8
RE-SETTING NEW RTO WITHIN THE PREDETERMINED RANGE
ESTABLISHING NEW RTO
S9
TRANSMITTING PACKET
S10
END

Fig. 4

Fig. 5

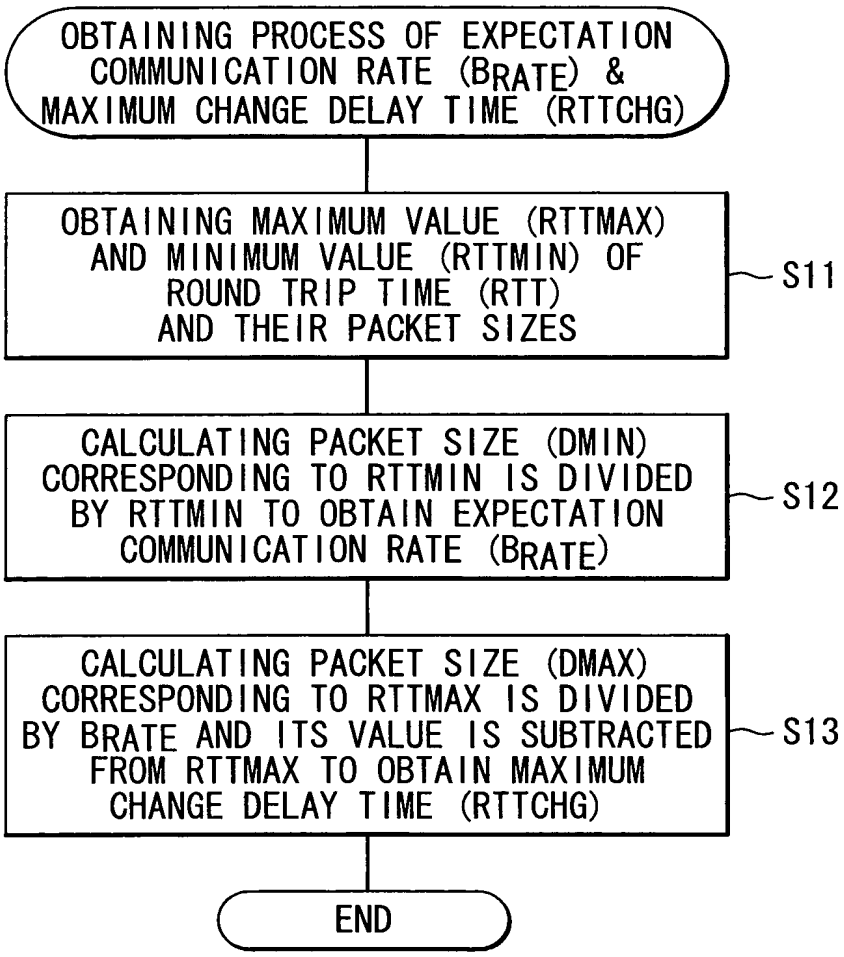
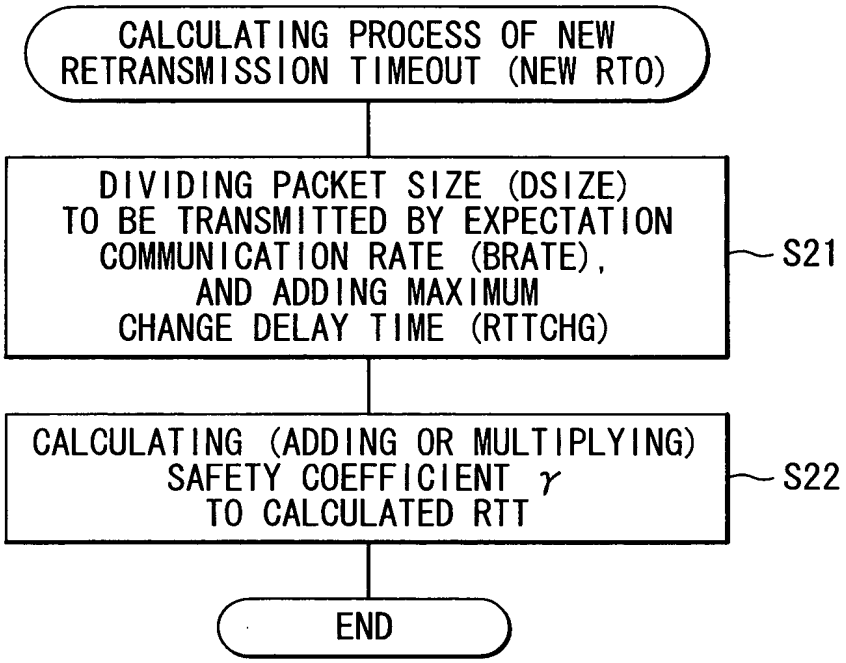

OBTAINING PROCESS OF EXPECTATION COMMUNICATION RATE (B_{RATE}) & MAXIMUM CHANGE DELAY TIME (RTTCHG)
OBTAINING MAXIMUM VALUE (RTTMAX) AND MINIMUM VALUE (RTTMIN) OF ROUND TRIP TIME (RTT) AND THEIR PACKET SIZES
S11
CALCULATING PACKET SIZE (DMIN) CORRESPONDING TO RTTMIN IS DIVIDED BY RTTMIN TO OBTAIN EXPECTATION COMMUNICATION RATE (B_{RATE})
S12
CALCULATING PACKET SIZE (DMAX) CORRESPONDING TO RTTMAX IS DIVIDED BY B_{RATE} AND ITS VALUE IS SUBTRACTED FROM RTTMAX TO OBTAIN MAXIMUM CHANGE DELAY TIME (RTTCHG)
S13
END

Fig. 6


CALCULATING PROCESS OF NEW RETRANSMISSION TIMEOUT (NEW RTO)
DIVIDING PACKET SIZE (DSIZE) TO BE TRANSMITTED BY EXPECTATION COMMUNICATION RATE (BRATE), AND ADDING MAXIMUM CHANGE DELAY TIME (RTTCHG)
S21
CALCULATING (ADDING OR MULTIPLYING) SAFETY COEFFICIENT γ TO CALCULATED RTT
S22
END

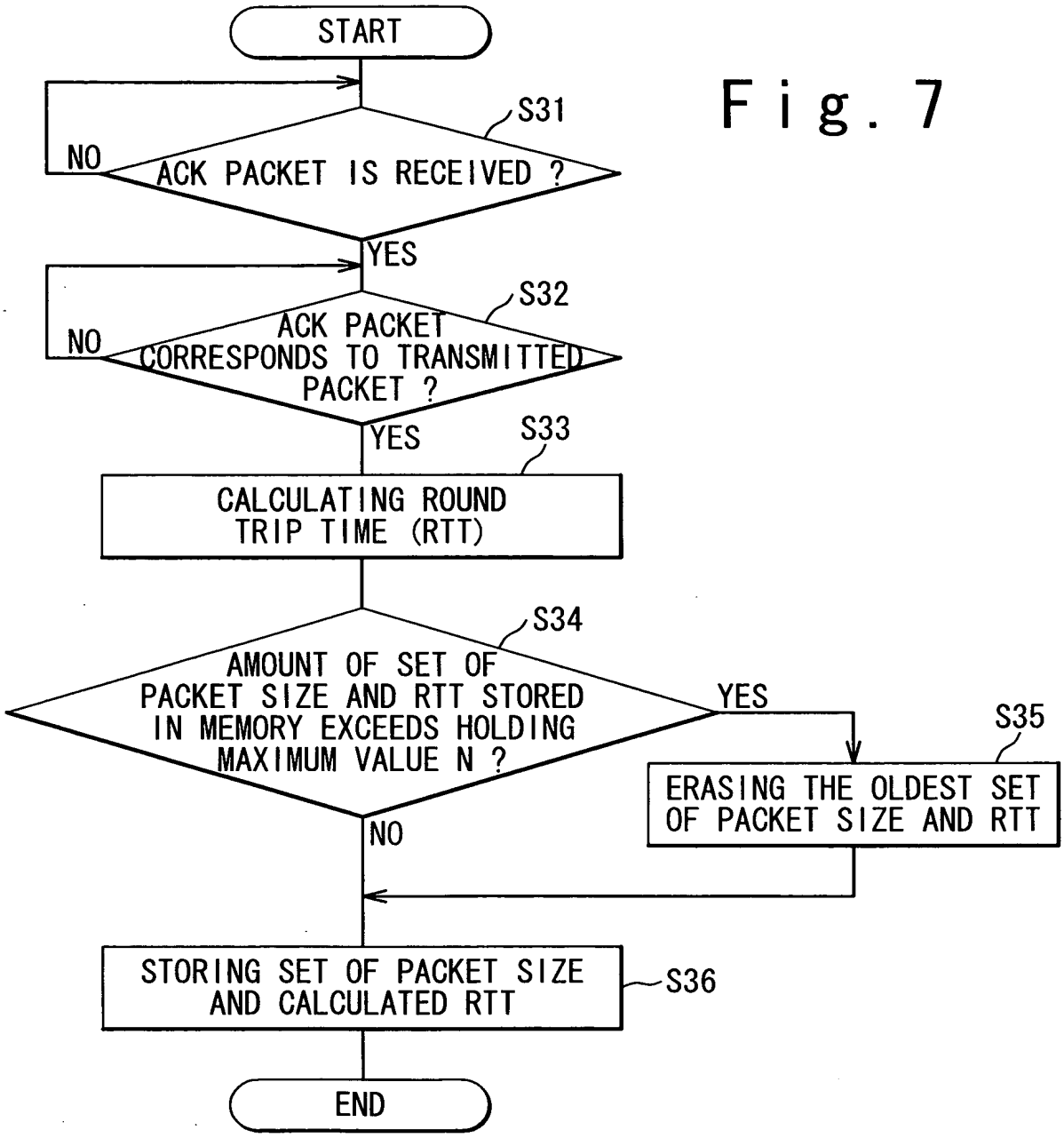

START
S31
NO
ACK PACKET IS RECEIVED ?
YES
S32
NO
ACK PACKET CORRESPONDS TO TRANSMITTED PACKET ?
YES
S33
CALCULATING ROUND TRIP TIME (RTT)
S34
AMOUNT OF SET OF PACKET SIZE AND RTT STORED IN MEMORY EXCEEDS HOLDING MAXIMUM VALUE N ?
YES
S35
ERASING THE OLDEST SET OF PACKET SIZE AND RTT
NO
STORING SET OF PACKET SIZE AND CALCULATED RTT
S36
END

Fig. 7

Fig. 8

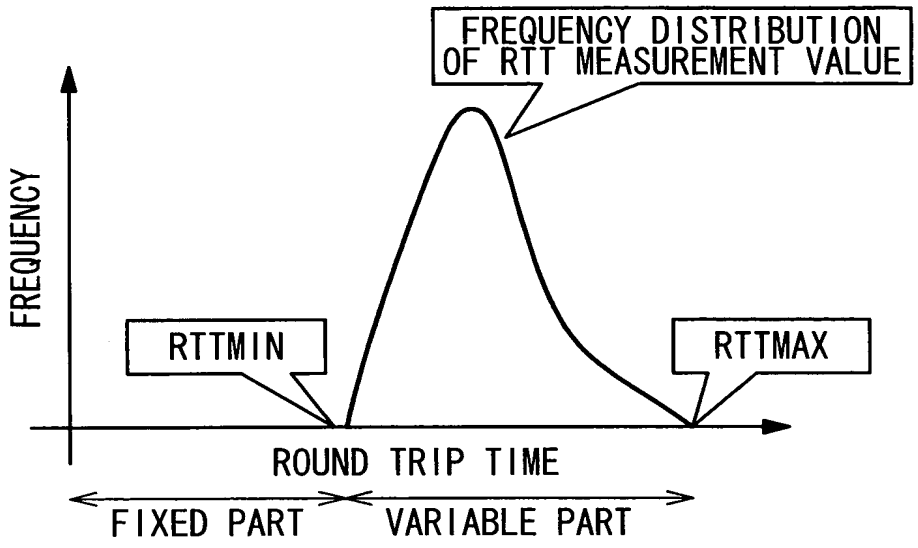

FREQUENCY DISTRIBUTION OF RTT MEASUREMENT VALUE
FREQUENCY
RTTMIN
RTTMAX
ROUND TRIP TIME
FIXED PART
VARIABLE PART

Fig. 9

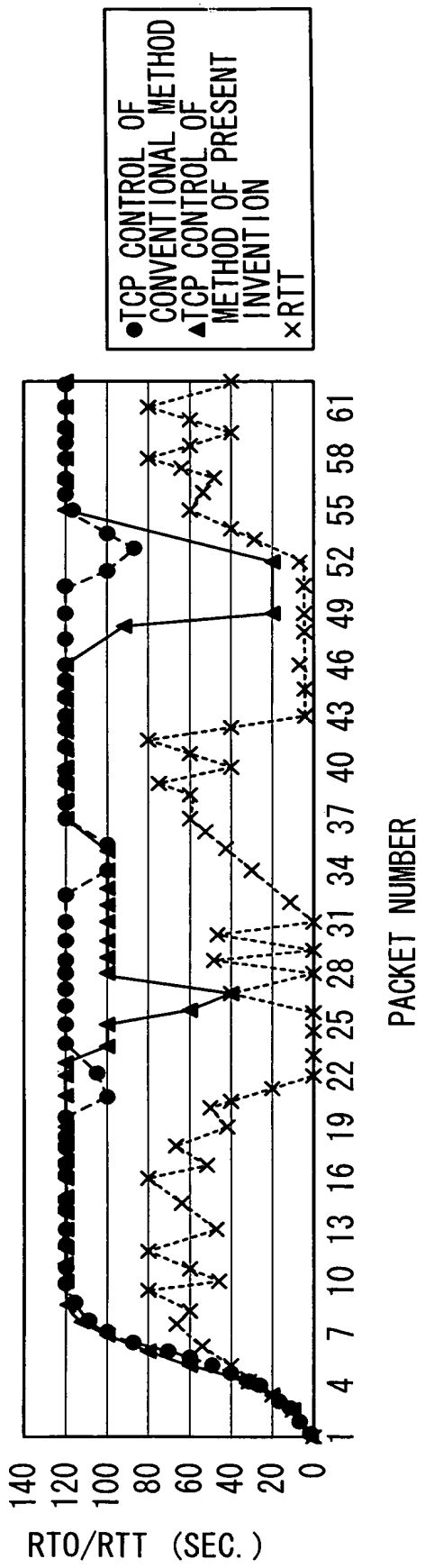

●TCP CONTROL OF CONVENTIONAL METHOD
▲TCP CONTROL OF METHOD OF PRESENT INVENTION
×RTT
RTO/RTT (SEC.)
140
120
100
80
60
40
20
0
1 4 7 10 13 16 19 22 25 28 31 34 37 40 43 46 49 52 55 58 61
PACKET NUMBER

Fig. 10

21

TRAFFIC SITUATION	EXPECTATION COMMUNICATION RATE (B_{RATE})	MAXIMUM CHANGE DELAY TIME (RTT_{chg})
T1	B_{RATE}#1	RTT_{chg}#1
T2	B_{RATE}#2	RTT_{chg}#2
T3	B_{RATE}#3	RTT_{chg}#3
T4	B_{RATE}#4	RTT_{chg}#4
⋮	⋮	⋮
Tm	B_{RATE}#m	RTT_{chg}#m

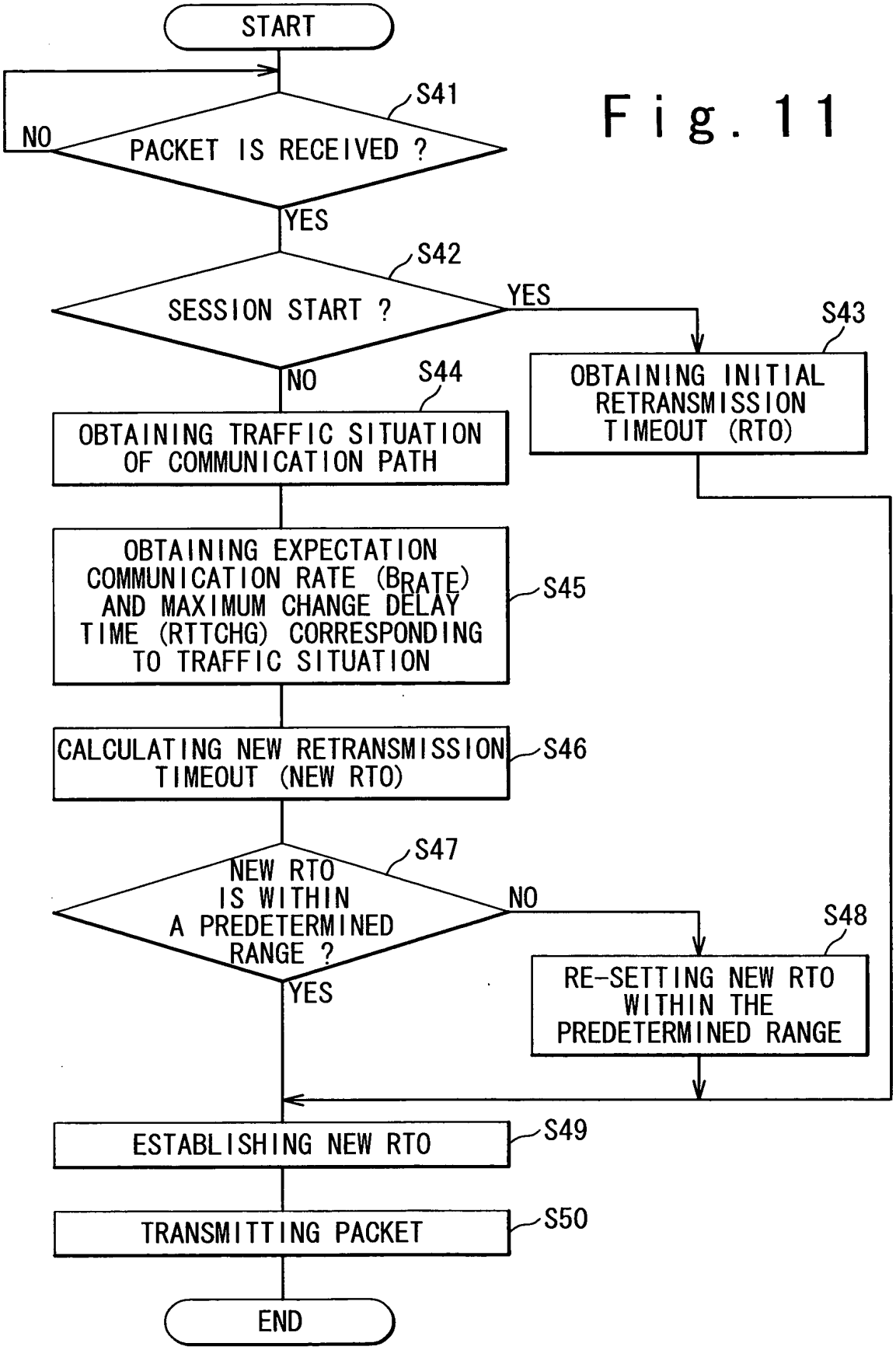

START
S41
PACKET IS RECEIVED ?
NO
YES
S42
SESSION START ?
YES
S43
OBTAINING INITIAL RETRANSMISSION TIMEOUT (RTO)
NO
S44
OBTAINING TRAFFIC SITUATION OF COMMUNICATION PATH
OBTAINING EXPECTATION COMMUNICATION RATE (B_{RATE}) AND MAXIMUM CHANGE DELAY TIME (RTTCHG) CORRESPONDING TO TRAFFIC SITUATION
S45
CALCULATING NEW RETRANSMISSION TIMEOUT (NEW RTO)
S46
S47
NEW RTO IS WITHIN A PREDETERMINED RANGE ?
NO
S48
RE-SETTING NEW RTO WITHIN THE PREDETERMINED RANGE
YES
ESTABLISHING NEW RTO
S49
TRANSMITTING PACKET
S50
END

Fig. 11

Fig. 12

21

CHANNEL QUALITY	EXPECTATION COMMUNICATION RATE (B_{RATE})	MAXIMUM CHANGE DELAY TIME (RTT_{chg})
C1	B_{RATE}#1	RTT_{chg}#1
C2	B_{RATE}#2	RTT_{chg}#2
C3	B_{RATE}#3	RTT_{chg}#3
C4	B_{RATE}#4	RTT_{chg}#4
⋮	⋮	⋮
Ck	B_{RATE}#k	RTT_{chg}#k

Fig. 13

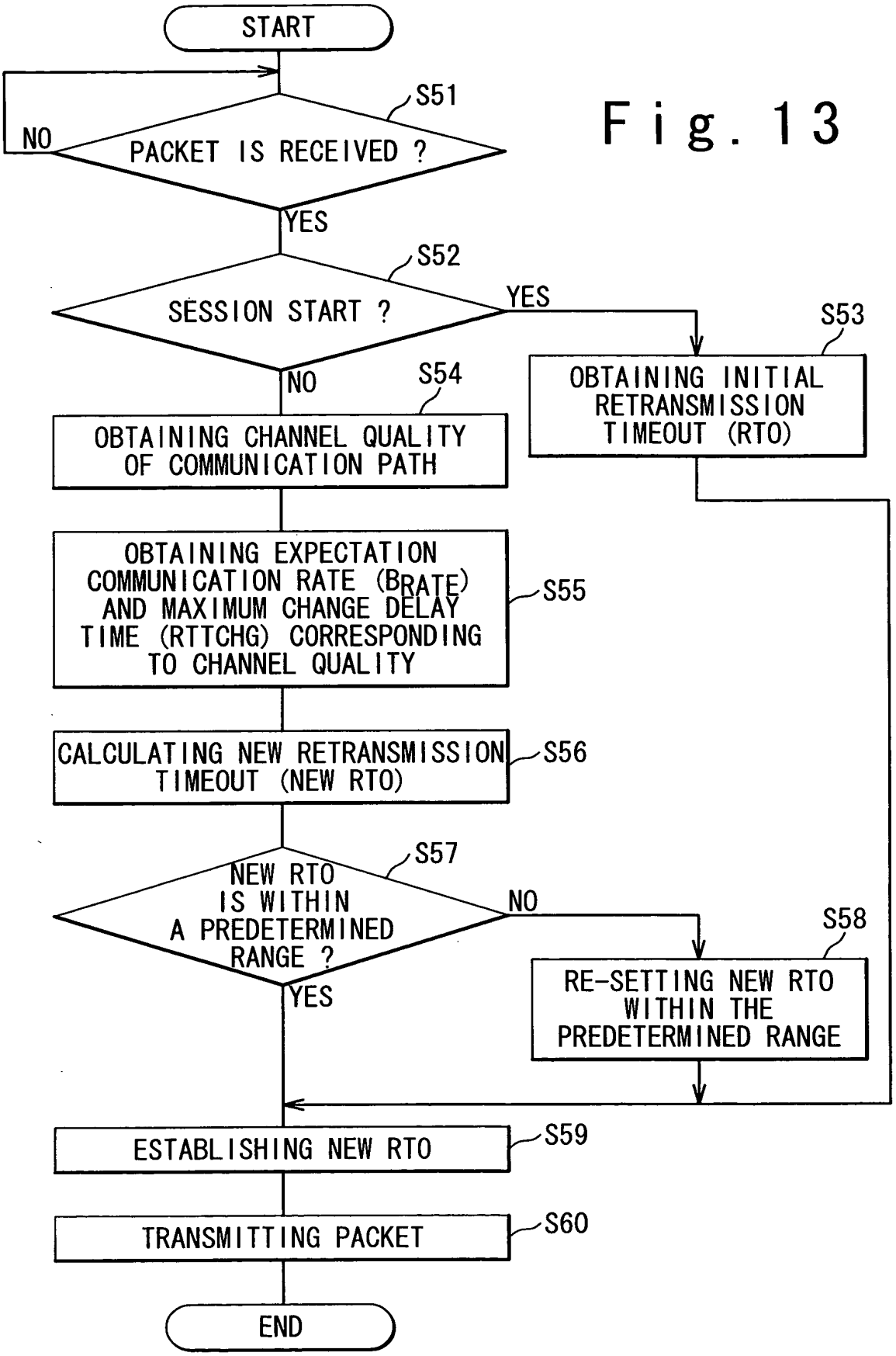

START
S51
PACKET IS RECEIVED ?
NO
YES
S52
SESSION START ?
YES
S53
OBTAINING INITIAL RETRANSMISSION TIMEOUT (RTO)
NO
S54
OBTAINING CHANNEL QUALITY OF COMMUNICATION PATH
OBTAINING EXPECTATION COMMUNICATION RATE (BRATE) AND MAXIMUM CHANGE DELAY TIME (RTTCHG) CORRESPONDING TO CHANNEL QUALITY
S55
CALCULATING NEW RETRANSMISSION TIMEOUT (NEW RTO)
S56
S57
NEW RTO IS WITHIN A PREDETERMINED RANGE ?
NO
S58
RE-SETTING NEW RTO WITHIN THE PREDETERMINED RANGE
YES
ESTABLISHING NEW RTO
S59
TRANSMITTING PACKET
S60
END

Fig. 14

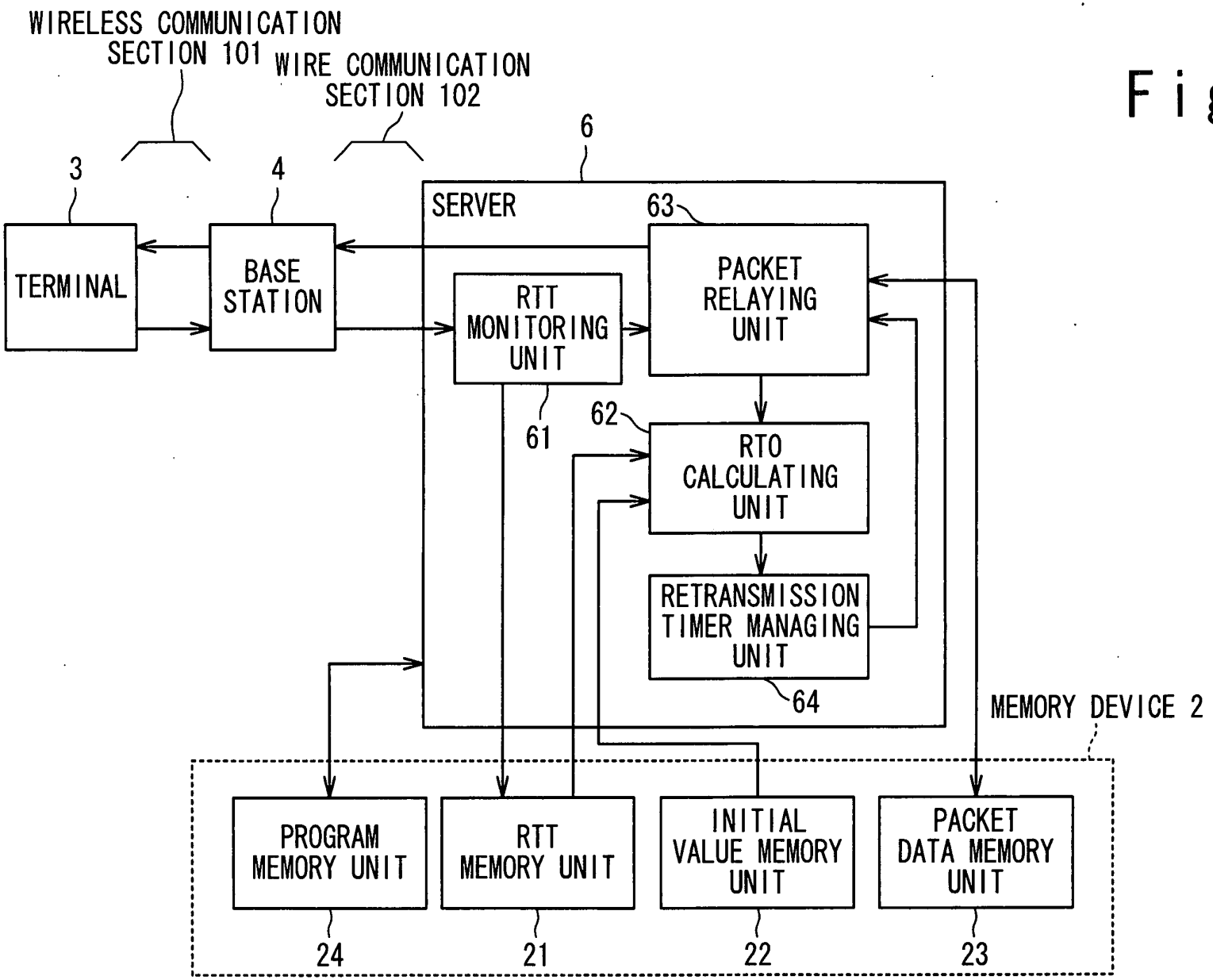

WIRELESS COMMUNICATION SECTION 101
WIRE COMMUNICATION SECTION 102
6
3
4
SERVER
63
TERMINAL
BASE STATION
RTT MONITORING UNIT
PACKET RELAYING UNIT
61
62
RTO CALCULATING UNIT
RETRANSMISSION TIMER MANAGING UNIT
64
MEMORY DEVICE 2
PROGRAM MEMORY UNIT
RTT MEMORY UNIT
INITIAL VALUE MEMORY UNIT
PACKET DATA MEMORY UNIT
24
21
22
23

Fig. 15

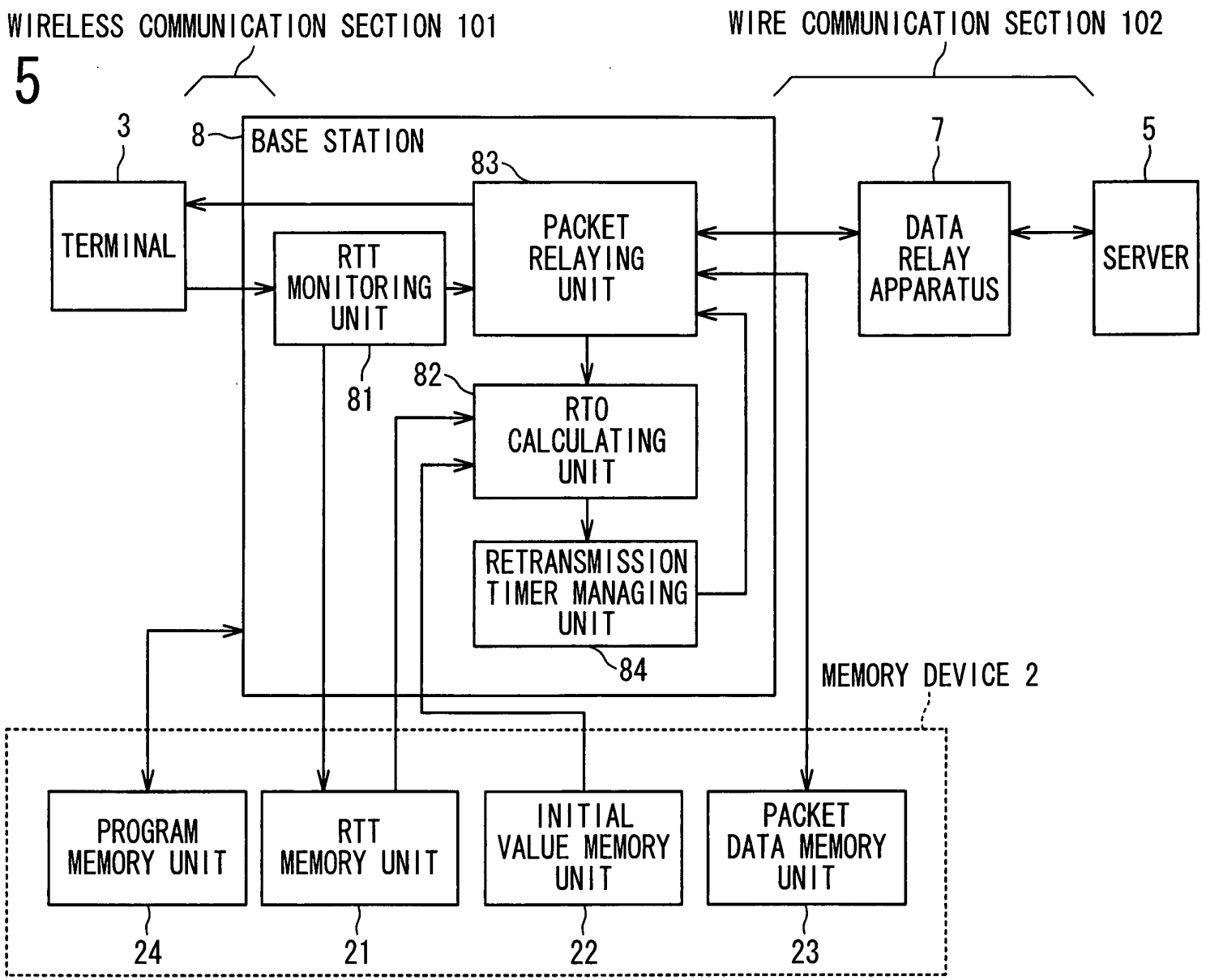

WIRELESS COMMUNICATION SECTION 101
WIRE COMMUNICATION SECTION 102
3
8
BASE STATION
83
7
5
TERMINAL
RTT MONITORING UNIT
PACKET RELAYING UNIT
DATA RELAY APPARATUS
SERVER
81
82
RTO CALCULATING UNIT
RETRANSMISSION TIMER MANAGING UNIT
84
MEMORY DEVICE 2
PROGRAM MEMORY UNIT
RTT MEMORY UNIT
INITIAL VALUE MEMORY UNIT
PACKET DATA MEMORY UNIT
24
21
22
23

Fig. 16

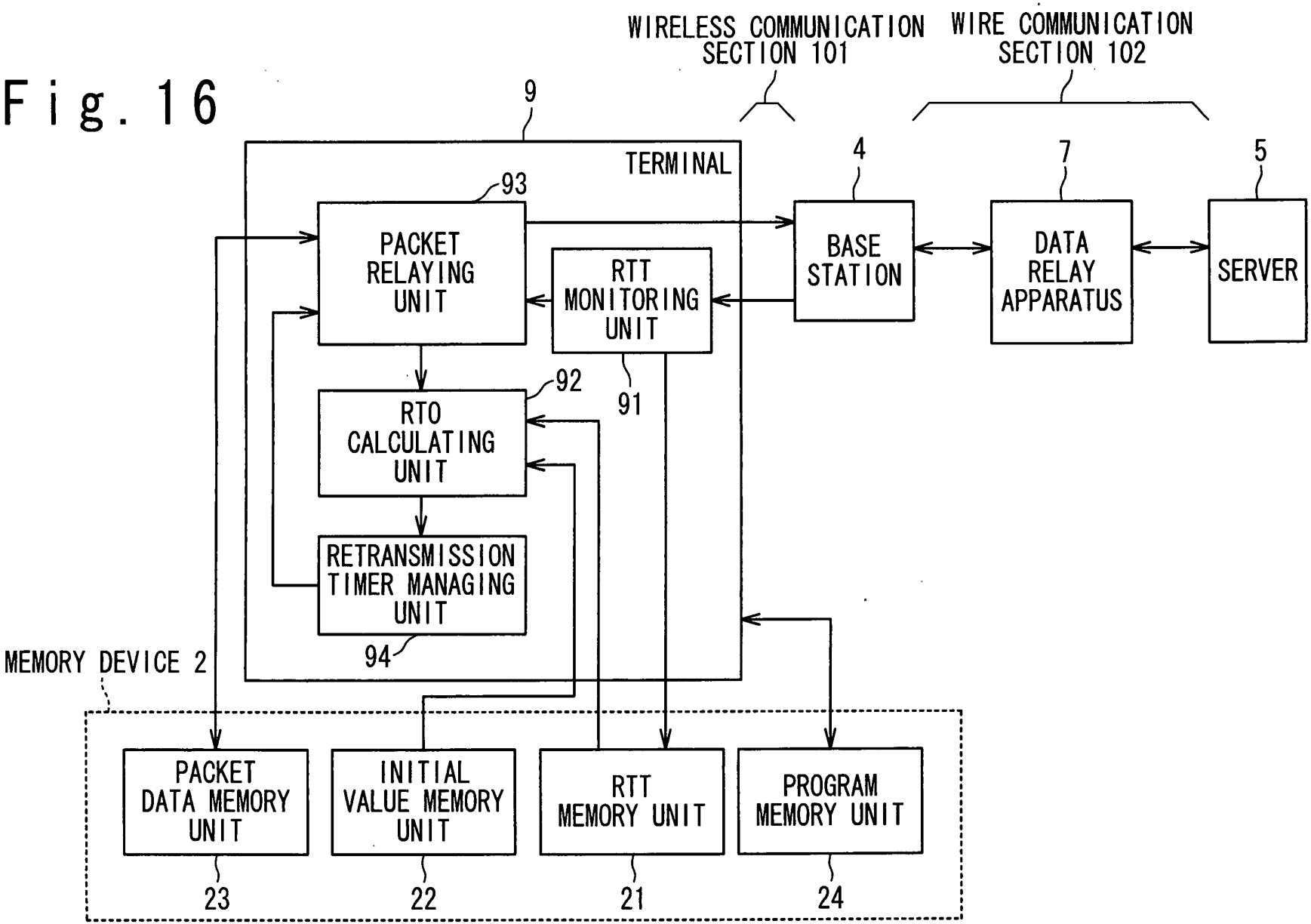

WIRELESS COMMUNICATION SECTION 101
WIRE COMMUNICATION SECTION 102
9
TERMINAL
93
PACKET RELAYING UNIT
RTT MONITORING UNIT
91
92
RTO CALCULATING UNIT
RETRANSMISSION TIMER MANAGING UNIT
94
4
BASE STATION
7
DATA RELAY APPARATUS
5
SERVER
MEMORY DEVICE 2
PACKET DATA MEMORY UNIT
23
INITIAL VALUE MEMORY UNIT
22
RTT MEMORY UNIT
21
PROGRAM MEMORY UNIT
24

Fig. 17

21

TIME ZONE	EXPECTATION COMMUNICATION RATE (B_{RATE})	MAXIMUM CHANGE DELAY TIME (RTT_{chg})
D1	B_{RATE}#1	RTT_{chg}#1
D2	B_{RATE}#2	RTT_{chg}#2
D3	B_{RATE}#3	RTT_{chg}#3
D4	B_{RATE}#4	RTT_{chg}#4
⋮	⋮	⋮
Dp	B_{RATE}#p	RTT_{chg}#p